No. LVIII.

Extract from a paper on the Meteoric Stones, written by F. R. Hassler Esq. Mathematical Professor in the Military School at West Point.

Read June 17th, 1808.

THE first thing to be considered on the supposition that these bodies are projected from the moon, is, whether the power exerted by any lunar volcano can be sufficient to throw a heavy body beyond the sphere of its predominant attraction, and of course enter that of the earth. This may be made a subject of calculation on the following principles.

Heavenly bodies exercise an attractive power in the direct ratio of their masses, and inverse ratio of the squares of their distances. Let A, M, and D, represent the attraction, mass, and distance of the earth; a, m, d, those of the moon; then the whole force exerted by the two bodies will be $A : a :: \frac{M}{D^2} : \frac{m}{d^2}$.

A body placed in circumstances most favourable to the hypothesis would of course be between the two bodies, and in a right line with the centers of both; and in order to be merely suspended in equilibrio between them, the two first terms of this proportion must be equal to each other, and the two last must also be equal, that is, $\frac{M}{D^2} = \frac{m}{d^2}$.

Now, taking M to be, in round numbers, equal to 70m, and D+d equal to the distance of the moon from the earth=D, the equation transformed becomes $\frac{70m}{\overline{D-d}^2} = \frac{m}{d^2}$, from which d is found $= \frac{D}{1+\sqrt{70}}$; but D=60×the radius of the earth, which is, in round numbers, equal to the mean distance of the moon;

therefore $\frac{D}{1+\sqrt{70}} = \frac{60 \text{ rad. earth}}{9.366} = 6.406 \times$ the radius of the earth; and multiplying by 3.67, the ratio of the radius of the earth to that of the moon, d=23.5×radius of the moon, which diminished by one radius of the moon, leaves $22\frac{1}{2}$ times the radius of the moon, or 24310.4 miles for the distance to which a heavy body must be thrown by some internal power of the moon, in order to remain suspended between the moon and earth.

According to the ratio of the quantity of matter in the moon and earth, and the observed rate of falling of a heavy body at the surface of the earth in the first second of time, the rate of falling at the surface of the moon is equal to 3.018 feet. Now, let g=this rate=3.018, s=the distance to which the body must be thrown=24310.4 miles; V=the initial velocity, or the velocity which the body must have at leaving the surface of the moon, then $V=2\sqrt{gs}=39364.3$ feet, or about $7\frac{1}{2}$ miles per second, or more than ten times the velocity of the moon in its orbit. Can we believe that there exists in the moon any internal power, capable of producing this effect? When we consider how small the attraction of gravitation is at the moon, would not the existence of such a projectile force prove in the lapse of ages, destructive to that body? And when centuries, and even thousands of years have passed away without any diminution of its magnitude, are we not irresistibly led to deny that there is in the moon any power of projecting a part of itself beyond the sphere of its own attraction?

No. LIX.

Extract of a letter from a member of the Society, relative to the great cold in January, 1807, at the town of Hallowell, in the district of Maine, Massachusetts, Head of tide-water on Kennebeck River. Communicated by John Vaughan.

Hallowell, January 29, 1807,

THE cold here on the night of the 22d—23d, brought the